

R E M A R K S

Claims 21 to 32 as set forth in Appendix II of this paper are now pending in this case. Claims 21 to 25 have been amended, and Claims 26 to 32 have been added as indicated in Appendix I of this paper.

In addition to editorial changes which were made in the language of Claims 21 to 25, applicants have replaced the reference to "*mixtures thereof*" in Claim 21, subsection (a) by the wording --a mixture thereof--, and have replaced the expression "*obtainable by*" in Claims 22 to 25 by the phrase --which is obtained by-- as suggested by the Examiner. New Claims 26 to 32 have been added to further bring out some of the subsidiary embodiments disclosed on pages 3 and 4 of the application. No new matter has been added.

Applicants have reviewed the application as suggested by the Examiner, but have not noticed any errors. Accordingly, the application should be in proper form.

The Examiner has rejected Claims 21 to 25 under 35 U.S.C. §112, ¶2, as being indefinite in view of the expressions "*obtainable*", "*mixtures thereof*" and "*passivation*". As indicated in the foregoing, applicants' amendment removes the expressions "*obtainable by*" and "*mixtures thereof*" in favor of the wording suggested by the Examiner. With regard to the term "*passivation*", however, the Examiner's position is not understood. On the one hand, applicants' disclosure specifically explains the meaning of "*passivation*" on page 5 of the (particularly the section indicated lines 17 to 26) application. A person of ordinary skill in the art who is reading the claims with due consideration of the supporting description of the invention would therefore have no problem to ascertain the metes and bounds of the term "*passivation*" or, more pertinently, of the subject matter defined in Claim 22. On the other hand, the term "*passivation*" is well known in the art as, for example, corroborated by the disclosure of *Flick et al.* (ie. col. 3, indicated lines 31 to 36, of US 5,527,946). The Examiner will note that the teachings of *Dewdney et al.* refer to a similar process albeit by the expression "*stabilization*" (ie. col. 4, indicated line 43 et seq., of US 3,986,985, and col. 4, indicated line 43 et seq., of US 4,064,172). Since the prior art corroborates that a person of ordinary skill in the pertinent art is well aware of the meaning

of the term "passivation" the metes and bounds of that term and of the subject matter defined in Claim 22 are immediately apparent even without a consultation of applicants' supporting description of the invention. The "distinctly claim" requirement of 35 U.S.C. §112, ¶2, means that claims must have a clear and definite meaning when construed in the light of the complete application or patent document (Standard Oil Co. v. American Cyanamid Co., 774 F.2d 448, 227 USPQ 293 (CAFC 1985)), and the test of definiteness is whether one skilled in the art would understand the bounds of the claim when read in the light of the specification (Morton Int. Inc. v. Cardinal Chem. Co., 5 F.3d 1464, 28 USPQ2d 1190 (CAFC 1993); Orthokinetics Inc. v. Safety Travel Chairs, Inc., 806 F.2d 1565, 1 USPQ2d 1081 (CAFC 1986)). Since the term "passivation" has a clear and definite meaning when construed in the light of the complete application, and a person of ordinary skill would understand the bounds of the claim when reading it with -or even without- due consideration of the information provided in applicants' description, the term cannot be considered to render the subject matter of applicants' claims unpatentable under the provisions of Section 112, ¶2, of the Patent Act. Favorable reconsideration of the Examiner's position and withdrawal of the respective rejection is therefore respectfully solicited.

The Examiner has rejected Claims 21 to 25 under 35 U.S.C. §103(a) as being unpatentable in light of the teaching of *Dewdney et al.* (US 3,986,985, in the following also referred to as *Dewdney (I)*), or *Dewdney et al.* (US 4,064,172, in the following also referred to as *Dewdney (II)*), or *Flick et al.* (US 5,527,946).

Applicants' invention is drawn to a hydrogenation catalyst that, in addition to an iron component (ie. iron, an iron compound, or a mixture thereof) comprises the following components in the following relative amounts (based on the amount of the iron component):

- from 0.001 to 0.3% by weight of a promoter based on 2, 3, 4 or 5 elements selected from the group consisting of aluminum, silicon, zirconium, titanium and vanadium,
- from 0.001 to 1% by weight of manganese, and
- from 0 to 0.3% by weight of a compound based on an alkali and/or alkaline earth metal,

(ie. Claim 21).

The teachings of the *Dewdney et al.* references are essentially identical (US 4,064,172 is a divisional case of US 3,986,985) and relate to an iron based catalyst for the hydrogenation of adiponitrile to hexamethylenediamine which catalyst comprises not less than 96.5% of iron oxide and wherein the atomic ratio of iron to oxygen is from 1.2:1 to 1.4:1 (ie. col. 2, indicated lines 14 to 24, of US 4,064,172, and col. 2, indicated lines 10 to 20, of US 3,986,985). More particularly, *Dewdney et al.* disclose catalysts which comprise, in addition to the iron component

- 0.2% by weight of alumina,
- 0.5 or 1.5<sup>(a)</sup>% by weight of silica,
- 0.1 or 0.2<sup>(a)</sup>% by weight of calcium oxide, and
- 0.2 or 0<sup>(a)</sup>% by weight of vanadium pentoxide

(ie. Examples 1 to 5, col. 6, indicated line 10, to col. 7, indicated line 30, of US 4,064,172, and col. 6, indicated line 12, to col. 7, indicated line 40, of US 3,986,985; <sup>(a)</sup> "Comparative Example").

To establish prima facie obviousness, all claim limitations must be taught or suggested by the prior art (ie. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)). Neither one of the *Dewdney et al.* references teaches or suggests the addition of manganese to the catalyst material. To the contrary, *Dewdney et al.* teach that it is preferred "not to make any addition, other than iron oxide or iron, to the feed before or during fusion, as is done, for example, when promoters are added to iron oxide in the manufacture of ammonia synthesis catalysts" (ie. col. 2, indicated lines 60 to 64, of US 4,064,172, and col. 2, indicated lines 56 to 61, of US 3,986,985). Also, the mere fact that it is possible to modify the teachings of the prior art in some manner is not sufficient to render a particular modification, ie. the modification which is necessary to arrive at the features of the claimed subject matter, prima facie obvious (*In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (CAFC 1984)). Accordingly, the disclosure of either one of the *Dewdney et al.* references taken alone, or both of the *Dewdney et al.* references taken together, is insufficient to support a finding that applicants' catalyst as defined in Claim 21 and further specified in Claims 22 to 32 would have been prima facie obvious under 35 U.S.C. §103(a) at the time applicants made the invention.

The Examiner contends that the *Dewdney et al.* references teach a catalyst composition which is based on iron and which *inter alia* contains a compound based on alkali metal or an alkaline earth metal, pointing to the abstract and the disclosure in col. 1, indicated lines 9 to 17, and in col. 2, indicated lines 14 to 39, of *Dewdney (II)*. Applicants respectfully submit that they are unable to find support for the Examiner's position in the teaching of *Dewdney et al.* On the one hand, neither the abstract nor the section in col. 2, indicated lines 14 to 39, of *Dewdney (II)* suggests or implies the addition of a compound based on an alkali metal or an alkaline earth metal, and the same applies to the initial part of the section in col. 1 of *Dewdney (II)* where the invention of *Dewdney et al.* is addressed. The subsequent paragraphs in col. 1 of *Dewdney (II)* discuss the background art of *Dewdney et al.*'s invention without, however, specifically noting the presence of a compound based on alkali metal or an alkaline earth metal. Also, the statement of *Dewdney et al.* that the addition of promoters as known for iron oxide catalysts suitable for the synthesis of ammonia is preferably omitted (ie. col. 2, indicated lines 60 to 64, of US 4,064,172, and col. 2, indicated lines 56 to 61, of US 3,986,985) dissuades a person of ordinary skill in the art to modify the catalyst of *Dewdney et al.* in such a manner. On the other hand, even if compound based on an alkali metal or an alkaline earth metal were present in the material disclosed by *Dewdney et al.* or if a person of ordinary skill in the art were inclined to add such a compound to *Dewdney et al.*'s catalyst, the resulting material would still differ from applicants' catalyst because it does not comprise manganese in the requisite amounts.

In light of the foregoing, applicants respectfully disagree with the Examiner's position that the difference between the claimed invention and the disclosure of *Dewdney et al.* merely resides in the generic description of the catalysts and the ratios. Favorable reconsideration of the Examiner's position is respectfully solicited.

The disclosure of *Flick et al.* relates to a catalyst for the partial hydrogenation of  $\alpha,\omega$ -dinitriles to  $\alpha,\omega$ -aminonitriles which catalyst is composed of

- (a) a nickel, cobalt, iron, ruthenium or rhodium compound,
- (b) from 0.01 to 25% of a promoter based on a metal selected from the group of palladium, iridium, osmium, iron, copper, silver,

gold, chromium, molybdenum, tungsten, manganese, rhenium, zinc, cadmium, lead, aluminum, tin, phosphorus, arsenic, antimony, bismuth and rare earth metals, and

(c) from 0 to 5% of a compound based on an alkali metal or on an alkaline earth metal

(ie. col. 1, indicated line 62, to col. 2, indicated line 12, of US 5,527,946). In accordance with the illustrative examples for suitable catalysts disclosed in col. 2 of *Flick et al.* the respective hydrogenation catalysts are based on either cobalt oxide or nickel oxide as component (a). In those cobalt oxide or nickel oxide catalysts component (b) is a combination of

- 5% by weight manganese oxide and 3% by weight of phosphorus pentoxide (ie. a total of 8% by weight of promoter elements),
- 5% by weight manganese oxide, 0.3% by weight of silver oxide, 3.5% by weight of alumina and 0.5% by weight of iron oxide (ie. a total of 9.3% by weight of promoter elements), and additionally 70% by weight of silica, or
- 3.7% by weight of alumina and 0.8% by weight of iron oxide (ie. a total of 4.5% by weight of promoter elements), and additionally 66.4% by weight of silica,

and component (c) is

- 2% by weight of sodium oxide,
- 0.5% by weight of magnesium oxide and 0.5% of calcium oxide, or
- 0.76% of magnesium oxide, 1.92% of calcium oxide, 3.4% by weight of sodium oxide and 2.0% of potassium oxide.

Apart from the fact that the respective illustrations differ from applicants' catalyst in the metal oxide component (a), the illustrative examples of *Flick et al.* are vastly different from applicants' catalyst in the composition and ratio of the promoter elements. With a view to catalysts having iron oxide as main component (a) *Flick et al.* teach -in the abstract- that catalysts based on iron and having a promoter component (b) based on either one of titanium, manganese, chromium or molybdenum are not within their disclosure.

To establish prima facie obviousness, all claim limitations must be taught or suggested by the prior art (ie. *In re Royka*, *ibid.*). The *Flick et al.* reference neither teaches nor suggests the addition of manganese to a catalyst material which is based on iron. To the

contrary, *Flick et al.* specifically point out that such a combination is not encompassed by their disclosure. Furthermore, the disclosure of *Flick et al.* fails to teach or suggest the combination of a promoter made from at least two elements selected from the group consisting of aluminum, silicon, zirconium, titanium and vanadium in a combined amount of from 0.001 to 0.3% by weight, with manganese in an amount of from 0.001 to 1 % by weight as suitable promoter composition for an iron based hydrogenation catalyst. The mere fact that it is possible to modify the teachings of the prior art in some manner is not sufficient to render a particular modification, ie. the modification which is necessary to arrive at the features of the claimed subject matter, prima facie obvious (*In re Gordon, ibid.*). Accordingly, the disclosure of the *Flick et al.* reference taken alone is insufficient to support a finding that applicants' catalyst as defined in Claim 21 and further specified in Claims 22 to 32 would have been prima facie obvious under 35 U.S.C. §103(a) at the time applicants made the invention.

The Examiner contends that *Flick et al.* teach the preparation of hexamethylenediamine, and that the catalyst utilized by *Flick et al.* for that purpose is iron based and comprises silica and titanium oxide as a promoter referring to the abstract and the disclosure in col. 2, indicated lines 33 to 38, of *Flick et al.* It is respectfully noted that *Flick et al.* attempt to reduce the formation of hexamethylenediamine in the partial hydrogenation of adipodinitrile to improve the formation of aminocapronitrile (note, for example, the statement "In the novel process, alpha, omega-aminonitriles are obtained in good selectivities and with only small amounts of hexamethylenediamine." in col. 4, indicated lines 36 to 38, of US 5,527,946). It is further respectfully submitted that applicants are unable to find a disclosure for an iron based catalyst which comprises silica and titanium oxide as a promoter constituents in the teaching of *Flick et al.* On the one hand, the abstract of *Flick et al.* specifically excludes such catalyst compositions from the disclosure. On the other hand, the representative catalysts disclosed in col. 2, indicated lines 27 to 45, of *Flick et al.* are (i) based on cobalt or nickel, and (ii) do not comprise titanium oxide.

It is further respectfully urged that a person of ordinary skill could not have arrived at the features of applicants' catalyst by contemplating the disclosure of either one or both of the *Dewdney et*

al. references together with the teaching of *Flick et al.* On the one hand, the catalyst disclosed in the *Dewdney et al.* references is adapted for the preparation of hexamethylenediamine whereas the catalyst disclosed by *Flick et al.* is adapted to reduce the formation of hexamethylenediamine. The combination of these references would clearly render each of them unsatisfactory for their individually intended purposes. Accordingly, a person of ordinary skill would not have been motivated to combine either one or both of the *Dewdney et al.* references together with the teaching of *Flick et al.* The combination of the respective prior art teachings in the manner which is necessary to arrive at the essential features of applicants' catalyst cannot be deemed to have been suggested by the references because *Dewdney et al.* teach that the addition of promoter components to the iron based hydrogenation catalyst is undesirable and *Flick et al.* specifically exclude iron based hydrogenation catalysts which comprise a manganese promoter.

The Examiner contends that the substitution of one catalyst for another would result in the same product and that one skilled in the art would be motivated to combine or modify the disclosure of the referenced prior art to achieve an improved product yield and/or purity. In light of the fact that the product which results from the hydrogenation in accordance with the teaching of the *Dewdney et al.* references differs from the product which results from the process taught by *Flick et al.* it is not apparent to applicants which "same product" a person of ordinary skill in the art could reasonably expect to obtain by combining the features of the catalysts disclosed in the references. Also, applicants fail to see a connection between achieving the same product and improving product yield and/or purity implied by the Examiner. Substituting catalysts may or may not improve the product yield and/or purity, and may very well lower either of these qualities in a given reaction sequence.

In light of the foregoing amendments and remarks, Claims 21 to 32 are deemed to fully meet the requirements of 35 U.S.C. §103(a). Favorable reconsideration of the Examiner's position and withdrawal of the respective rejection is respectfully solicited.

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Respectfully submitted,

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Encl.: THE CHANGES IN THE CLAIMS (Appendix I)  
THE AMENDED CLAIMS (Appendix II)

HBK/BAS



## A P P E N D I X I:

THE CHANGES IN THE CLAIMS:

Amend Claims 21 to 25 as indicated in the following:

21. (amended) A hydrogenation catalyst comprising
- (a) iron or a compound based on iron or [~~mixtures~~] a mixture thereof,
  - (b) from 0.001 to 0.3% by weight based on (a) of a promoter based on 2, 3, 4 or 5 elements selected from the group consisting of aluminum, silicon, zirconium, titanium and vanadium,
  - (c) from 0 to 0.3% by weight based on (a) of a compound based on an alkali and/or alkaline earth metal, and [~~also~~]
  - (d) from 0.001 to 1% by weight based on (a) of manganese.
22. (amended) [~~A hydrogenation~~] The catalyst [~~, as claimed~~] defined in claim 21, [~~obtainable~~] which is obtained by reduction with or without subsequent passivation of a magnetite.
23. (amended) [~~A hydrogenation~~] The catalyst [~~, as claimed~~] defined in claim 21, [~~obtainable~~] which is obtained by precipitating precursors of said components (a), (b), (d) and optionally (c) in the presence or absence of support materials.
24. (amended) [~~A hydrogenation~~] The catalyst [~~, as claimed~~] defined in claim 21, [~~obtainable~~] which is obtained by impregnating a support with a solution of said components (a), (b), (d) and optionally (c).
25. (amended) [~~A hydrogenation~~] The catalyst [~~, as claimed~~] defined in claim 21, [~~obtainable~~] which is obtained by spraying said components (a), (b), (d) and optionally (c) onto a support.

Enter new Claims 26 to 32 as follows:

26. (new) The catalyst defined in claim 21, which has a BET surface area of from 3 to 20 m<sup>2</sup>/g, a total pore volume of from 0.05 to 0.2 mL/g, an average pore diameter of from 0.03 to 0.1 μm and a 0.01 to 0.1 μm pore volume fraction within the range from 50 to 70%.
27. (new) The catalyst defined in claim 21, wherein component (b) is based on aluminum, silicon and titanium.

28. (new) The catalyst defined in claim 21, wherein component (c) is based on magnesium and/or calcium.
29. (new) The catalyst defined in claim 21, wherein component (c) is present in an amount of from 0.01 to 0.2% by weight based on (a).
30. (new) The catalyst defined in claim 21, wherein component (c) is present in an amount of from 0.01 to 0.1% by weight based on (a).
31. (new) The catalyst defined in claim 21, wherein component (d) is present in an amount of from 0.001 to 0.3% by weight based on (a).
32. (new) The catalyst defined in claim 21, wherein component (d) is present in an amount of from 0.01 to 0.2% by weight based on (a).